Title: Do You Measure Up?

Brief Overview:

Students will use a graphing calculator to model linear equations for a set of real-life data. The students will collect, organize, and analyze the data to determine if a linear correlation exists between the variables. Students will then summarize their findings in an oral and written report.

Links to Standards:

• **Mathematics as Problem Solving**
The students will demonstrate the ability to collect, organize, and make conclusions about the data collected.

• **Mathematics as Communication**
Students will communicate their research findings in an oral and written scientific report.

• **Mathematics as Reasoning**
Students, using deductive reasoning, will write a linear equation from real-life data to make reasonable predictions about the two variables using the equation.

• **Mathematical Connections**
Students will use technology and statistics to model real-life statistics and data.

• **Algebra**
Students will develop and use an equation to model data and make predictions.

• **Statistics**
Students will collect and analyze data.

Links to Maryland High School Mathematics Core Learning Goals

• **1.1.1** The student will recognize, describe, and extend patterns and functional relationships that are expressed numerically, algebraically, and geometrically
• **1.1.2** The student will represent patterns and functional relationships in a table, as a graph, and/or by mathematical expression.
• **1.2.1** The student will determine the equation for a line, solve linear equations, and describe the solutions using numbers, symbols, and graphs
• **2.2.3** The student will identify and use inductive and deductive reasoning.
• **3.1.1** The student will design and/or conduct an investigation that uses statistical methods to analyze data and communicate results.
• **3.1.3** The student will use stimulations to make statistical inferences from data to estimate the probability of an event.
• **3.2.1** The student will make informed decisions and predictions based upon the results of simulations and data from research.
• **3.2.2** The student will make predictions by finding and using a line of best fit and by using a given curve of best fit.

Grade/Level:

Grades 8-10

Duration/Length

Two 90-minute periods or four 40-minute periods

Prerequisite Knowledge:

Students should have working knowledge of the following:

- Use of TI-82/83 to enter data and to graph equations of lines
- Points, slopes, and equations of lines
- Evaluating algebraic expressions

Objectives:

Students will:

- use data to make scatter plots.
- use scatter plots to determine if there exists a positive, negative, or no association between two variables.
- find a linear equation that approximates a set of data points.
- use an equation to predict changes of one variable in terms of the other.

Materials/Resources/Printed Materials:

Per Group:

- TI-82/83 graphing calculator
- Tape Measure
- Packet of Group Activity Sheets (5)

Per Student:

- Group Evaluation Sheet(s)
- Peer Evaluation Sheets (one per student for each group)

Development/Procedures:

1. Students will work in groups of two or three to collect data by measuring and recording the foot length (f) and cubit (c) of at least 25 people (See Class Data Sheet).
2. Students will input data into TI-82/83 calculator and determine the equation of the line of best fit (See Activity Sheets #1-3).
3. Each group will produce a written scientific report on this project which should contain the objective, procedure, data, and the conclusion.
4. Each group should present the report orally to the class.

Performance Assessment:

    The teacher will supervise the groups to ensure they are completing the assigned project on a timely basis. The students, along with the teacher, will evaluate each group's oral presentation based the content of and the validity of the not only the data that the students collected, but the conclusions that were drawn as well. In the written portion of the project (see Expectations on Activity Sheet #1), the four activity sheets should be included as a part of the project. Each member within a group will complete an evaluation on the group's overall performance as well. Also, students should evaluate each other's performance within the group. The teacher may use these evaluations as one tool to help assess each project along with the quality of the written and oral reports as well.

Extension/Follow Up:

1. Groups may apply other variables to determine whether or not a linear relationship exists. If so, then they may analyze other data to draw conclusions.
2. Groups may examine the correlation coefficient to determine which regression (power, exponential, logarithmic) is the best fit for the relation.

Authors:

Emmanuel Asomugha
Woodrow Wilson S.H.S.
Washington, DC

Jennie R. Burgee
Elizabeth Seton High School
Archdiocese of Washington, DC

Edie Huffman
Prince George's County, MD

CLASS DATA SHEET

FOOTLENGTH   CUBIT

FOOTLENGTH	CUBIT

** CUBIT=LENGTH IN CENTIMETERS OF ARM FROM ELBOW TO TIP
   OF MIDDLE FINGER IN CENTIMETERS

** FOOTLENGTH=LENGTH IN CENTIMETERS OF FOOT FROM HEEL
   TO TIP OF BIG TOE IN CENTIMETERS

ACTIVITY #1

GROUP INSTRUCTION SHEET

GETTING STARTED:

1. Students will work in groups consisting of 2-3 members.

2. Each group will use a tape measure to measure the cubit and foot length for 25 different people.

3. Record Results in the Class Data Sheet .

4. Each group will present results in a written and oral report.

EXPECTATIONS:

1. Each group will work together to collect and analyze the data.

2. Each member of the group will write an evaluation to assess the performance of each person.

3. The group will input the data into the calculator to determine the relationship.

4. Each group is expected to write a report about the project. This report should contain information about the data, analysis, summary, and outcome. It should also contain the objective and procedure.

5. Each group will make an oral presentation about the report .

ACTIVITY #2

INPUTTING DATA AND MAKING A SCATTER PLOT WITH THE TI-82/83

## INPUTTING DATA

1. Turn the Calculator on.
2. Enter the cubit data into List one (L1)
   a. Clear previously entered data by pressing **2nd MEM** then select #4 (**CLR ALL LISTS**) and press **ENTER.**
   b. Press **STAT.**
   c. Press selection #1 (**EDIT**)
   d. Enter the data by entering cubit and pressing **ENTER.** Repeat this until all the information is entered.
3. Enter the foot length data into List Two (L2) by following steps 2b-d above. **DO NOT REPEAT STEP 2A!!!!!**

MAKING A SCATTER PLOT

1. Press **2nd   STAT PLOT** and press #1 **(Plot #1)**
2. Select: On
   Type: 1st graph, scatter plot, press enter.
   X List: L1, press enter
   Y List: L2, press enter
   Marks: You may select any mark you choose.
   (As in figure #1)

Figure #1
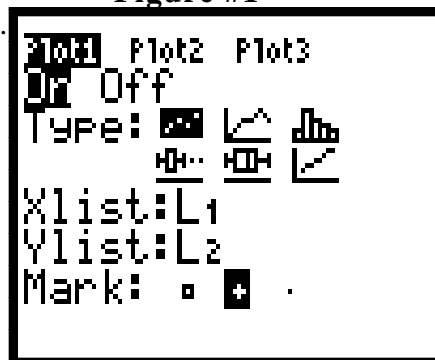
3. Press **CLEAR**
4. Press **ZOOM** select option **#9** .

A scatter plot should then appear on your calculator screen.

(If software is available, your group should print out a copy of the graph so you can include it in your written report and answer questions about the graph. If there is no access to the graphlink software, then your group should sketch a copy of the graph onto paper so you may include a copy of the graph in your written report.   Remember, neatness counts!)

ACTIVITY #3

CREATING A LINE OF BEST FIT ON TI-82/83 CALCULATOR

1. Calculator should be turned on.

2. Press **Y=**

3. Clear all Y= by pressing **CLEAR   ENTER** Repeat until all equations are deleted.

4. Press   **STAT**   enter option #4 **(LinReg(ax+b))**

5. Press **ENTER.**

6. Copy the values of a, b, and r .

7. Press **Y=**

8. Press **VARS.**

9. Press option #5 **(STATISTICS)**

10. Move cursor to the right two places until blinking on **EQ**

11. Press **ENTER r**ecord the equation on some paper for your reference.

12. Press **ZOOM** and option #9.

The equation is your line of best fit. You should see the scatter plot along with the "Line of Best Fit."

ACTIVITY #4

SUMMARY/CONCLUSIONS

AFTER COMPLETION OF THE PROJECT, PLEASE COMPLETE THE FOLLOWING QUESTIONS:

1. IS THERE A LINEAR RELATIONSHIP BETWEEN THE LENGTH OF THE FOOT VS. THE CUBIT IN THE SCATTER PLOT OF THE RELATION? EXPLAIN. IF A LINEAR RELATIONSHIP EXISTS, IS THE CORRELATION POSITIVE OR NEGATIVE?

2. WHAT IS THE SLOPE OF THE LINE? INTERPRET WHAT IT SAYS ABOUT THE FOOT LENGTH VS. THE CUBIT (EXPLAIN).

3. WHAT IS YOUR Y-INTERCEPT AND WHAT DOES IT SAY ABOUT THE FOOT LENGTH VS. THE CUBIT? EXPLAIN.

4. WHAT IS THE LINEAR EQUATION FOR THE DATA YOU COLLECTED? (YOUR EQUATION SHOULD NOT BE IN TERMS OF X AND Y, BUT IN TERMS OF YOUR VARIABLES.)

5. USING YOUR LINEAR EQUATION, DETERMINE THE FOOTLENGTH OF A PERSON WHOSE CUBIT IS 50 CM.

6. USING YOUR LINEAR EQUATION, DETERMINE THE CUBIT OF A PERSON WHOSE FOOTLENGTH IS 20.5 CM.

PRESENTATION EVALUATION SHEET

PLEASE COMPLETE THE EVALUATION FOR EACH GROUPS ORAL
PRESENTATION.

1. What were some positive aspects of the presentation?

2. What areas do you feel needed improvement?

3. Based on the group data, did you feel that the conclusions they presented were valid?
   Explain.

4. Please tell me your overall impressions of the presentation.

PEER EVALUATION SHEET

1. How did your group work overall together?

2. Did all members of the group equally participate in the project? Explain.

3. What did you enjoy most about working on this project with your group?

4. What did you dislike most about working in a group?

5. Assign a grade to each member of your group and explain your reasoning for the grade.